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Using Argonne's Modeling Software to Estimate Benefits of Alternative Fuel Vehicles

Andrew Burnham

Center for Transportation Research

Argonne National Laboratory

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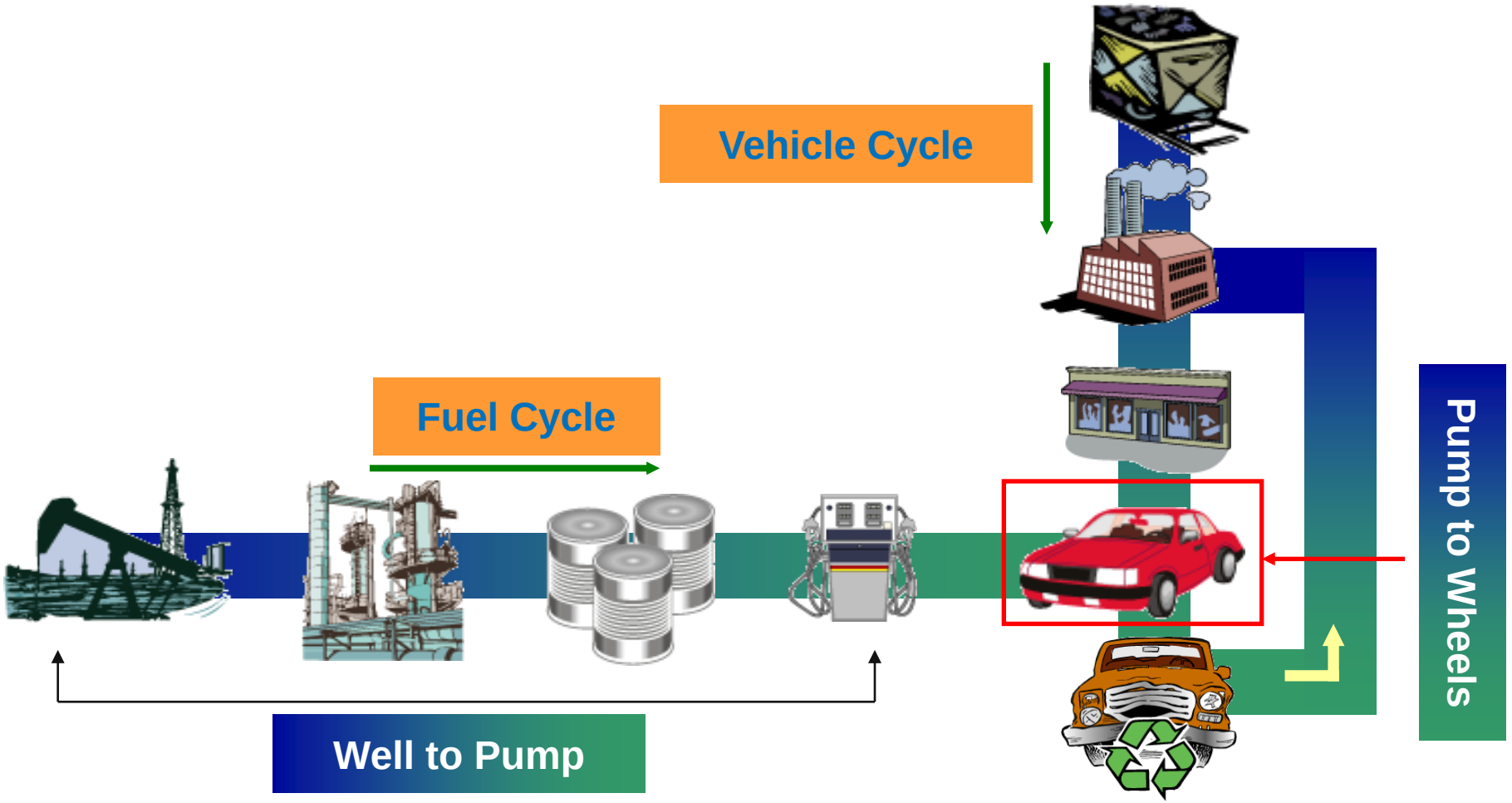
Outline of Presentation

- **GREET Model Introduction**
- **Current Lifecycle Research**
  - Ethanol
  - Biodiesel
  - Landfill gas
  - Plug-in hybrids
- **GREET Fleet Footprint Calculator Introduction**
- **GREET Fleet Demos**
- **AirCRED and MOVES**

Life-Cycle Analysis of Vehicle/Fuel Systems Includes Both Vehicle Cycle and Fuel Cycle



The GREET (Greenhouse gases, Regulated Emissions, and Energy use in Transportation) Model

- **Includes emissions of greenhouse gases**
  - CO_2, CH_4, and N_2O
- **Estimates emissions of six criteria pollutants**
  - Total and urban separately
  - VOC, CO, NO_x, SO_x, PM_{10}, and $PM_{2.5}$
- **Separates energy use into:**
  - All energy sources (fossil and non-fossil)
  - Fossil fuels (petroleum, natural gas, and coal combined)
  - Petroleum
  - Natural gas
  - Coal
- **The GREET model and its documents are available at Argonne's website at *http://www.transportation.anl.gov/modeling_simulation/GREET***
  - There are more than 10,000 registered GREET users worldwide
- **The most recent GREET fuel-cycle model (GREET1.8c.0) was released March 23, 2009**

The 2007 EISA and Low-Carbon Fuel Standard Development Require Life-Cycle Analysis for Fuels

- EISA requires LCAs to be conducted to determine if given fuel types meet mandated minimum GHG reductions
  - New ethanol produced from corn: 20%
  - Cellulosic biofuels: 60%
  - Biomass-based diesel (e.g., biodiesel): 50%
  - Other advanced biofuels (e.g., imported sugarcane ethanol, renewable diesel, CNG/LNG made from biogas): 50%
  - EPA released a notice of proposed rulemaking (NPRM) in early May 2009
- Low-carbon fuel standard development efforts in EU, California, and other states require LCAs for biofuels
- Life cycle analysis includes
  - All major GHGs (CO_2, CH_4, and N_2O)
  - Both production and use of fuels
  - Direct and indirect land use change impacts

California Has Adopted Low-Carbon Fuel Standards (LCFS) in April 2009

- 10% reduction in carbon intensity of CA fuel supply pool (in g CO_2e/MJ) by 2020
- GREET was used to develop fuel-specific carbon intensities
- Purdue's GTAP model was used for land use simulations
- Fuel carbon intensity may be adjusted with vehicle efficiency

Adopted Carbon Intensities for Selected Fuels (g CO2e/MJ)

Fuel	Direct Emissions	Land Use or other effects	Total
CA Gasoline	95.86	0	95.86
Midwest Corn EtOH	69.40	30	99.40
CA Corn EtOH, wet DGS	50.70	30	80.70
Sugarcane EtOH	27.40	46	73.40
CA Electricity	124.10	0	41.37
NG-Based H2	142.20	0	61.83

The U.S. EPA Released a Notice of Proposed Rulemaking for EISA RFS2 in May 2009

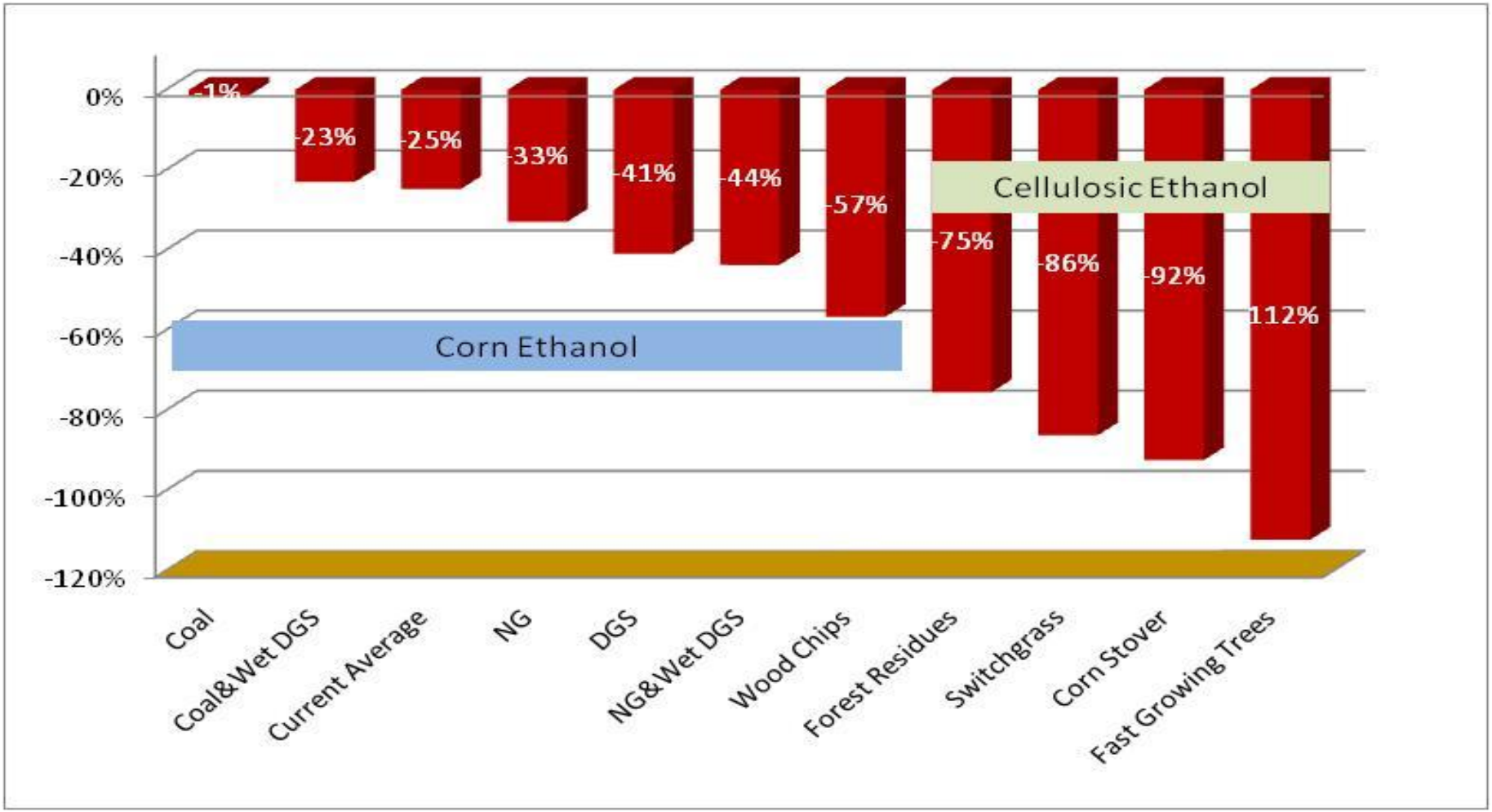
- A suite of models (including GREET) were used to conduct biofuel LCAs
- Land use change in EPA's NPRM, as well as in CA's LCFS, has been a contentious issue

EPA Estimated Biofuel GHG Changes (Relative to 2005 Gasoline)

	100 yr, 2% Discount	30 yr, 0% Discount	EISA Target
Corn EtOH	-16%	+5%	**-20%**
Sugarcane EtOH	-44%	-26%	**-50%**
Corn Stover EtOH	-115%	-117%	**-60%**
Switchgrass EtOH	-128%	-121%	**-60%**
Soybean Biodiesel	-22%	+4%	**-50%**
Waste Grease Biodiesel	-80%	-80%	**-50%**

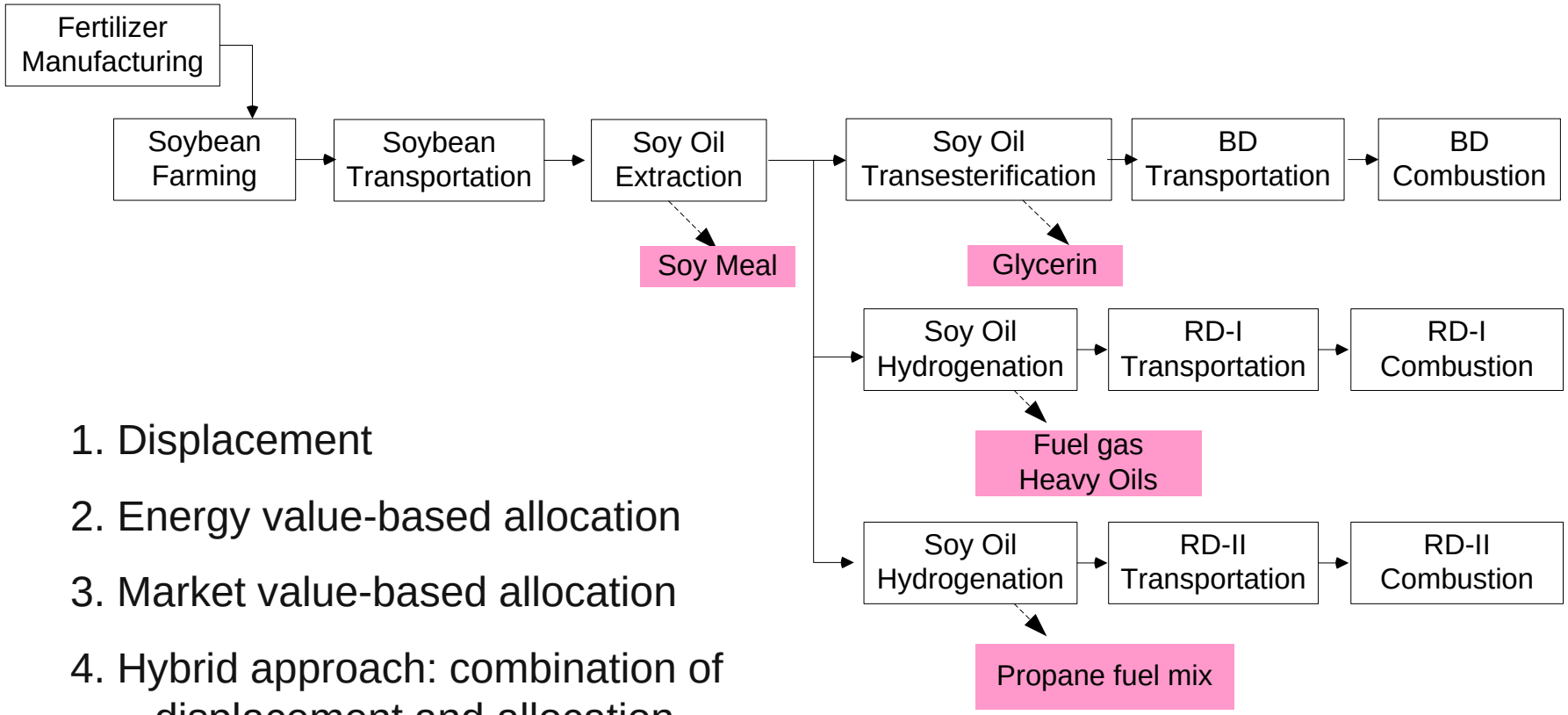
GHG Emissions of Corn Ethanol Vary Considerably Among Process Fuels in Plants

GREET Simulation - GHG Reductions by Ethanol Relative to Gasoline



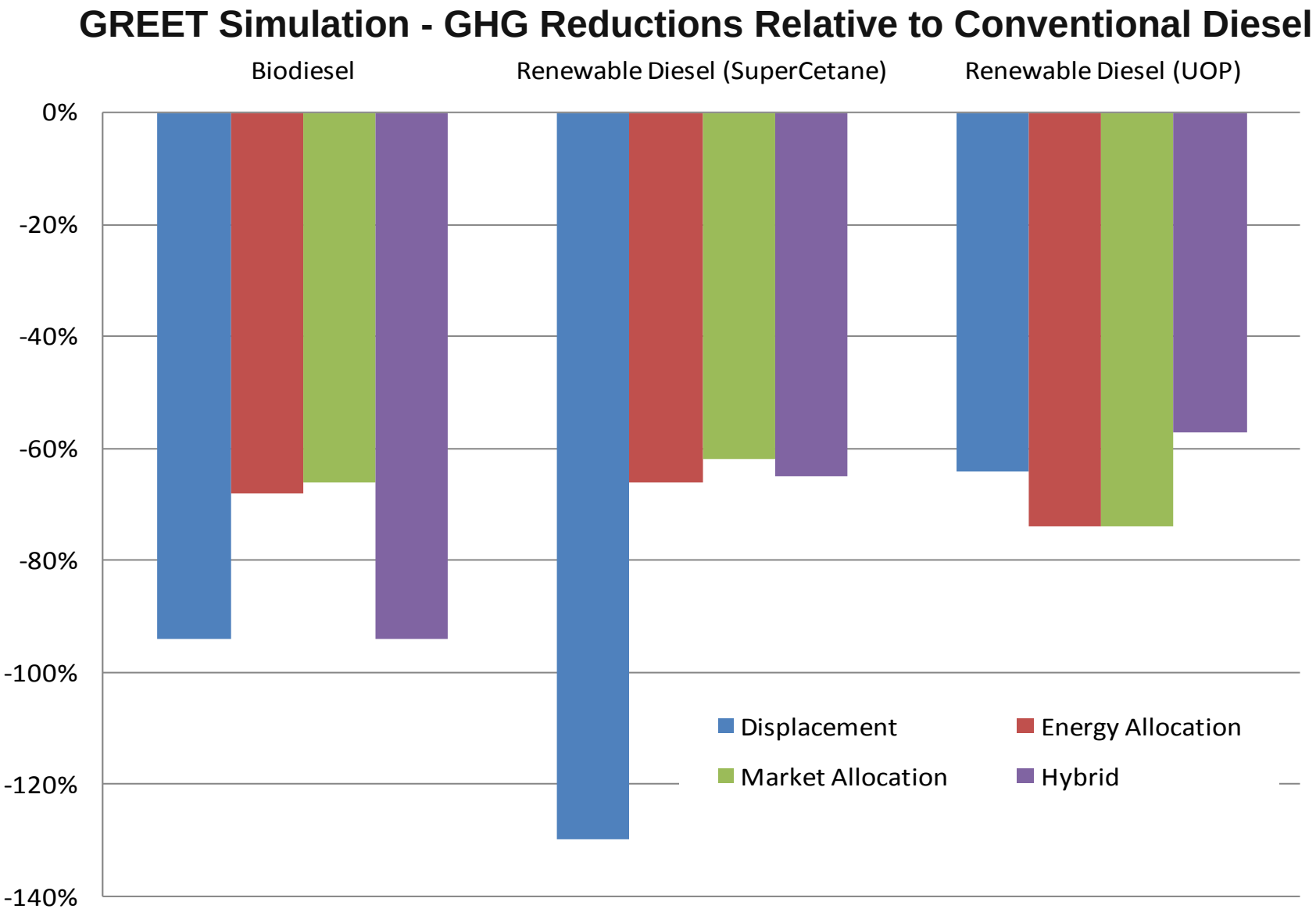
GHG effects of potential land use changes are not fully included in these results.

Four Allocation Approaches Were Employed in GREET to Address Various Co-Products of Biodiesel & Renewable Diesel



1. Displacement
2. Energy value-based allocation
3. Market value-based allocation
4. Hybrid approach: combination of displacement and allocation

GHG Reductions by Biodiesel & Renewable Diesel Depend Heavily on Co-Product Method in LCA



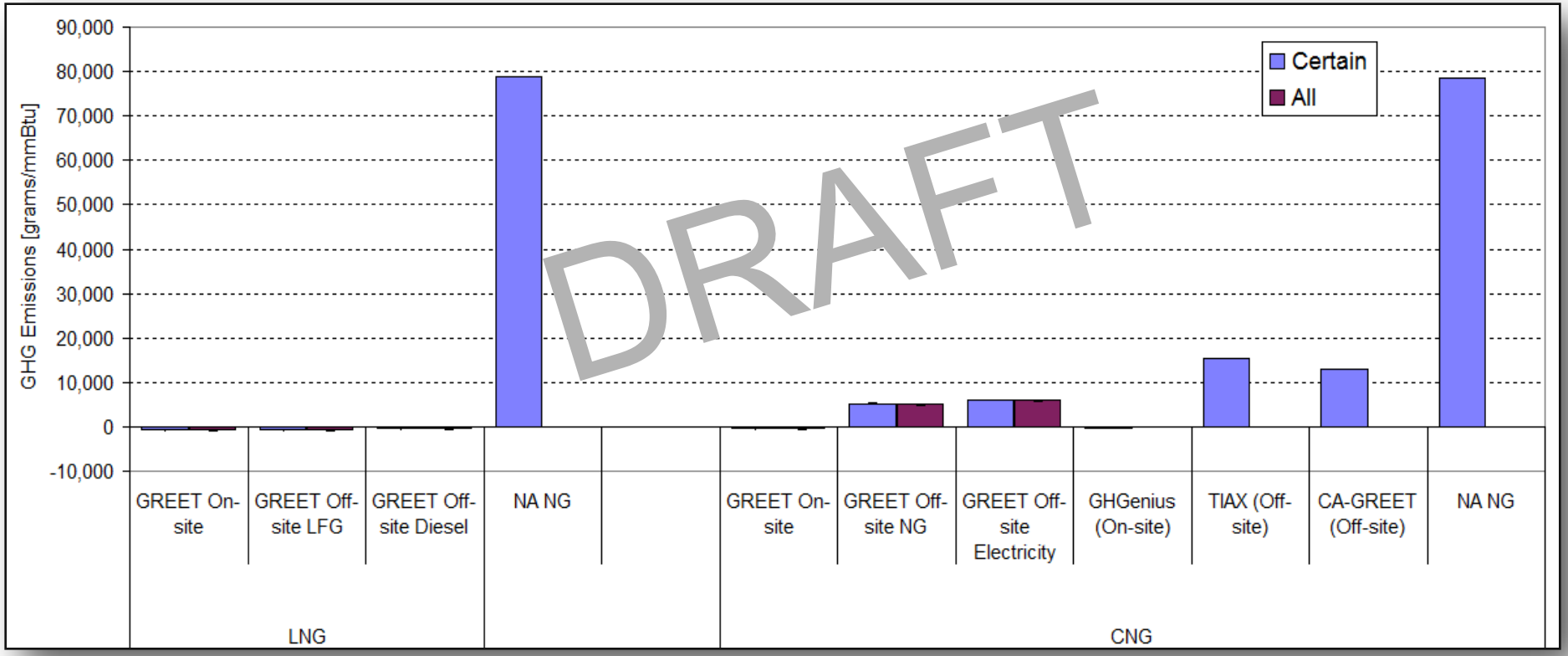
Energy & GHG Emissions of Landfill Gas to Vehicle Fuel Will Be Added to GREET

- Defined eight generic Well-to-Pump (WTP) pathways

	CNG		LNG	
CO_2 Co-product	Yes	No	Yes	No
Fueling				
Onsite	X	X	X	X
Offsite	X	X	X	X

- Developed necessary inputs
  - Characterized input feedstock and output fuel compositions
  - Collected and validated input, output and process flows (energy, carbon) for process technologies

GHG Emissions are Largely Eliminated with LFG Feedstock and in some Cases are Credits

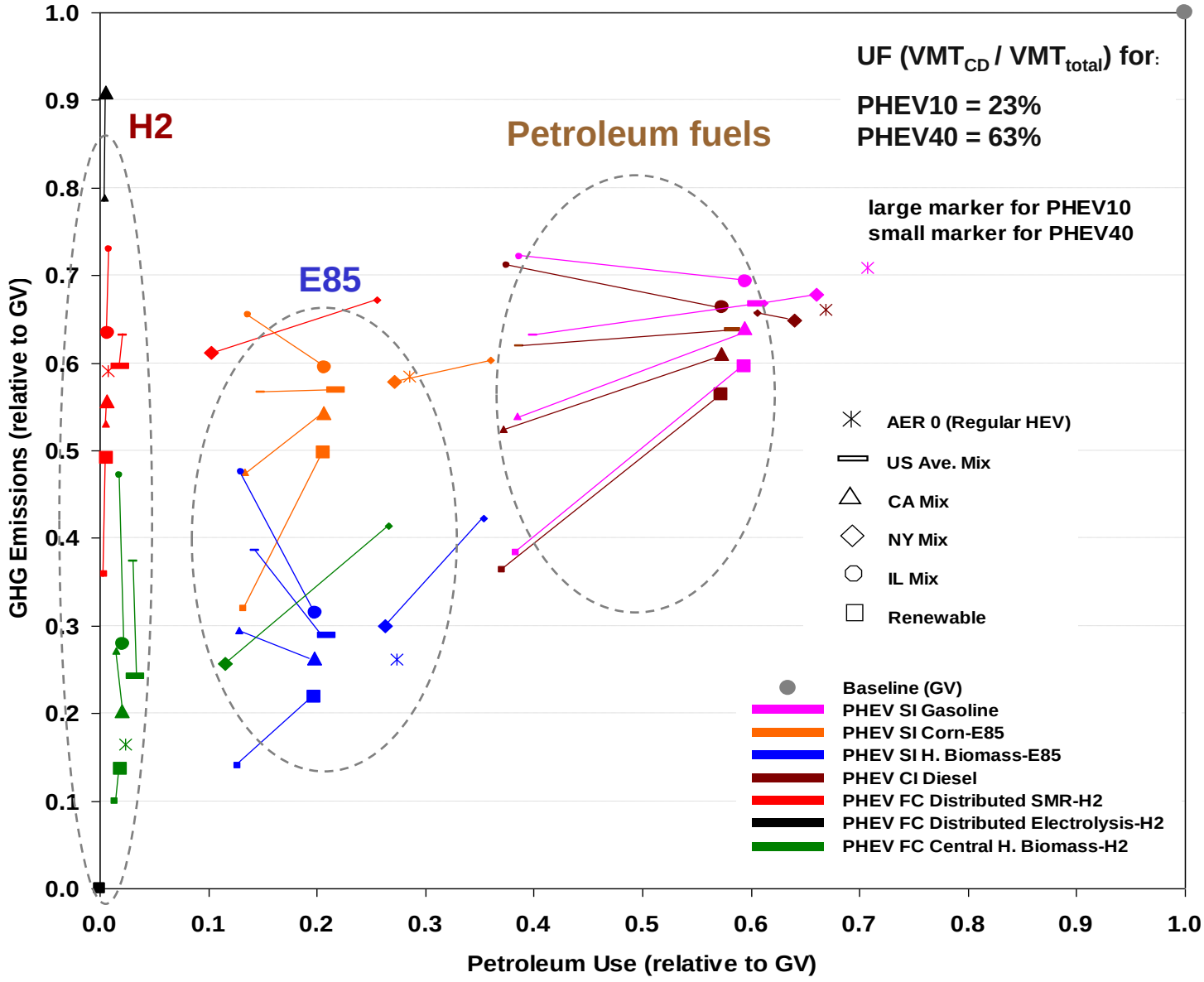


- Producing LNG and CNG from North American (NA) NG is the baseline

Argonne's Plug-in Hybrid (PHEV) WTW Analysis Addresses The Following Three Key Issues

- PHEV performance evaluation with Argonne's PSAT model
  - Explored PHEV operating strategies
  - Processed fuel economy results for various PHEV configurations
  - Examined effects of all electric ranges (AER) of PHEVs
- PHEV mileage shares by power source
  - Relied on national average distribution of daily vehicle miles traveled (VMT)
  - Determined VMT shares by charge depleting (CD) and charge sustaining (CS) operations for PHEVs with different AERs
- Electricity generation mixes to charge PHEVs
  - Reviewed studies completed in this area
  - Generated five sets of generation mixes for PHEV recharge

PHEV Petroleum Energy & GHG Effects of Favorable Options



GREET Fleet Allows Users to Estimate Petroleum and Carbon Footprints

- Starting in 1998, US DOE and EPA co-sponsored Argonne to develop a tool, AirCRED, to assist Clean Cities coalitions to estimate ozone precursor and carbon monoxide emission credits from AFVs
  - For use in State Implementation Plans (SIPs)

- Now with the interest in measuring petroleum use and carbon/greenhouse gas emissions, DOE sponsored Argonne to develop the GREET Fleet Footprint Calculator
  - Developed in Microsoft Excel and uses simple spreadsheet inputs

- This tool was designed for:
  - On-road medium and heavy duty vehicles
  - Off-road equipment

GREET Fleet Footprint Calculator is Available for Download

- The GREET Fleet Footprint Calculator and its user manual are available at Argonne's website at http://www.transportation.anl.gov/modeling_simulation/GREET/footprint_calculator.html
- GREET Fleet is based off the current public version of GREET (1.8c.0)
  - The calculations in GREET Fleet will be updated as they change in the actual GREET model
  - Our grand plan is to develop a comprehensive heavy duty GREET model
- Contains 13 fuel/vehicle types
  - Conventional: gasoline and diesel
  - Hybrid: diesel HEV
  - Alt. fuel: biodiesel (B20 and B100), ethanol (E85), CNG, LNG, landfill gas, LPG, electricity, gaseous and liquid hydrogen
    - *Additional simulation options include:*
      - Corn vs. cellulosic ethanol
      - Electricity mix (% coming from coal, natural gas, nuclear, etc.)
      - Several hydrogen production pathways

Tools that Examine Petroleum Use & Carbon Emissions

- Petroleum Reduction Planning Tool: provides users with petroleum reduction strategies for light and heavy duty vehicles
  - Includes AFVs, hybrids, improved fuel economy, reduced VMT, truck stop electrification & idling reduction
  - Calculations are based on vehicle operation (no upstream energy use)

- NAFA and Environmental Defense Fund's Fleet Greenhouse Gas Emissions Calculator: GHG emissions by fuel use for on-road and off-road vehicles
  - No upstream emissions

- Fueleconomy.gov: life-cycle petroleum use and carbon emission data
  - Only light duty vehicles certified by the EPA, no medium/heavy duty vehicles or off-road equipment
  - Uses Argonne's GREET model for background calculations

Comparing On-Road Vehicle Technologies for Potential Acquisitions

GREET Fleet Tutorial – Comparing On-Road Vehicle Technologies for Potential Acquisitions

- First step: choose how to calculate footprint on 'On-road fleet sheet'
  - Choose "Option 1" to calculate using fleet size, VMT & fuel economy

1. Method to Calculate On-Road Fleet's Petroleum Energy Use and GHG Footprint

1

1 - Fleet size, vehicle miles traveled, and fuel economy
2 - Fuel use (skip to question 5)

- Second step: enter the amount of vehicles
  - In this demo we will compare diesel transit buses to: diesel hybrid, B20, & CNG

2. The Number of Each Type of Vehicle in On-Road Fleet

	Gasoline	Diesel	Diesel HEV	Biodiesel (B20)	Biodiesel (B100)	Ethanol (E85)	Compressed Natural Gas (CNG)
School Bus	0	0	0	0	0	0	0
Transit Bus	0	20	20	20	0	0	20
Shuttle/Paratransit Bus	0	0	0	0	0	0	0
Waste Hauler	0	0	0	0	0	0	0
Street Sweeper	0	0	0	0	0	0	0
Delivery Step Van	0	0	0	0	0	0	0
Transport/Freight Truck	0	0	0	0	0	0	0
Medium/Heavy Duty Pickup Truck	0	0	0	0	0	0	0
Maintenance Utility Vehicle	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0

Note: Several fuels to the right of CNG are not shown for clarity in this presentation

GREET Fleet Tutorial – Comparing On-Road Vehicle Technologies for Potential Acquisitions

- Third step: enter the annual mileage

3. The Average Annual Vehicle Miles Traveled by Each Vehicle Type

	Gasoline	Diesel	Diesel HEV	B20	B100	E85	CNG
School Bus	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Transit Bus	30,000	50,000	50,000	50,000	30,000	30,000	50,000
Shuttle/Paratransit Bus	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Waste Hauler	23,400	23,400	23,400	23,400	23,400	23,400	23,400
Street Sweeper	12,600	12,600	12,600	12,600	12,600	12,600	12,600
Delivery Step Van	16,500	16,500	16,500	16,500	16,500	16,500	16,500
Transport/Freight Truck	80,000	80,000	80,000	80,000	80,000	80,000	80,000
Medium/Heavy Duty Pickup Truck	11,400	11,400	11,400	11,400	11,400	11,400	11,400
Maintenance Utility Vehicle	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Other	30,000	30,000	30,000	30,000	30,000	30,000	30,000

- Fourth step: enter the fuel economy

4. The Average Fuel Economy for Each Vehicle Type in the On-Road Fleet (miles per gasoline gallon equivalent)

	Gasoline	Diesel	Diesel HEV	B20	B100	E85	CNG
School Bus	6.0	7.0	8.5	7.0	7.0	6.0	6.0
Transit Bus	2.5	3.0	3.8	3.0	3.0	2.5	2.5
Shuttle/Paratransit Bus	7.0	8.0	10.0	8.0	8.0	7.0	7.0
Waste Hauler	2.0	2.5	3.0	2.5	2.5	2.0	2.0
Street Sweeper	3.0	4.0	5.0	4.0	4.0	3.0	3.0
Delivery Step Van	12.0	15.0	18.5	15.0	15.0	12.0	12.0
Transport/Freight Truck	5.0	6.0	7.5	6.0	6.0	5.0	5.0
Medium/Heavy Duty Pickup Truck	9.0	11.0	13.5	11.0	11.0	9.0	9.0
Maintenance Utility Vehicle	20.0	25.0	31.0	25.0	25.0	20.0	20.0
Other	2.5	3.0	3.8	3.0	3.0	2.5	2.5

Note: Several fuels to the right of CNG are not shown for clarity in this presentation

GREET Fleet Tutorial – Comparing On-Road Vehicle Technologies for Potential Acquisitions

- Fifth step: adjust fuel production assumptions if needed

6. Fuel Production Assumptions

Ethanol Feedstock Source	1	1 - Corn 2 - Switchgrass
CNG Feedstock Source	1	1 - North American NG 2 - Non-North American NG
LNG Feedstock Source	1	1 - North American NG 2 - Non-North American NG
LPG Feedstock Source	NG	Petroleum
	60%	40%
Source of Electricity for On-Road Electric Vehicles and H2 Electrolysis		
	1	1 - Average U.S. Mix 2 - Average Northeast Mix 3 - Average California Mix 4 - User Defined (go to 'Specs' sheet)
G.H2 Production Process	1	1 - Refueling Station SMR (On-site) 2 - Central Plant SMR (Off-site) 3 - Refueling Station Electrolysis (On-site)
L.H2 Production Process	1	1 - Refueling Station SMR (On-site) 2 - Central Plant SMR (Off-site) 3 - Refueling Station Electrolysis (On-site)

GREET Fleet Tutorial – Comparing On-Road Vehicle Technologies for Potential Acquisitions

- Final step: view petroleum and greenhouse gas results

7. Results of On-Road Fleet's Petroleum Usage (barrels)

	Gasoline	Diesel	Diesel HEV	B20	B100	E85	CNG	Vehicle Total
School Bus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transit Bus	0.0	7687.7	6069.3	6263.0	0.0	0.0	50.8	20070.8
Shuttle/Paratransit Bus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Waste Hauler	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Street Sweeper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Delivery Step Van	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transport/Freight Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Medium/Heavy Duty Pickup Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maintenance Utility Vehicle	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fuel Total	0.0	7,687.7	6,069.3	6,263.0	0.0	0.0	50.8	

On-Road Fleet Total **20,070.8** **barrels of oil**

8. Results of On-Road Fleet's Greenhouse Gas Emissions (short tons CO2-equivalent)

	Gasoline	Diesel	Diesel HEV	B20	B100	E85	CNG	Vehicle Total
School Bus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transit Bus	0.0	4,186.1	3,304.8	3560.8	0.0	0.0	4014.0	15065.6
Shuttle/Paratransit Bus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Waste Hauler	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Street Sweeper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Delivery Step Van	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transport/Freight Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Medium/Heavy Duty Pickup Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maintenance Utility Vehicle	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fuel Total	0.0	4,186.1	3,304.8	3,560.8	0.0	0.0	4,014.0	

On-Road Fleet Total **15,065.6** **short tons of GHG emissions**

Note: Several fuels to the right of CNG are not shown for clarity in this presentation

Calculating Current Off-Road Fleet's Footprint

GREET Fleet Tutorial – Calculating Current Off-Road Fleet's Footprint

- First step: choose how to calculate footprint on 'Off-road fleet sheet'
  - Choose "Option 2" to calculate by fuel use

1. Method to Calculate Off-Road Fleet's Petroleum Energy Use and GHG Footprint

2

1 - Fleet size, annual hourly usage, and brake horse power
2 - Fuel use (skip to question 5)

  - Skip to "Table 5"

GREET Fleet Tutorial – Calculating Current Off-Road Fleet's Footprint

- Second step: enter the fuel use
  - In this demo we will calculate the footprint of a gasoline air compressor & diesel, electric, and gaseous hydrogen forklifts

5. The annual total fuel use by fleet vehicle (gallons, cubic feet, or kilowatt-hours)

	Gasoline (gallons)	Diesel (gallons)	Diesel HEV (gallons)	B20 (gallons)	B100 (gallons)	E85 (gallons)	CNG (cubic feet)	LNG (gallons)	LFG (cubic feet)	LPG (gallons)	Electricity (kilowatt-hours)	G.H2 (cubic feet)	L.H2 (gallons)
Forklift	0	400	0	0	0	0	0	0	0	0	5,000	50,000	0
Skid Loader	0	0	0	0	0	0	0	0	0	0	0	0	0
Front-end Loader	0	0	0	0	0	0	0	0	0	0	0	0	0
Crane	0	0	0	0	0	0	0	0	0	0	0	0	0
Backhoe/Loader	0	0	0	0	0	0	0	0	0	0	0	0	0
Excavator	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulldozer	0	0	0	0	0	0	0	0	0	0	0	0	0
Asphalt Paver	0	0	0	0	0	0	0	0	0	0	0	0	0
Asphalt Roller	0	0	0	0	0	0	0	0	0	0	0	0	0
Compactor	0	0	0	0	0	0	0	0	0	0	0	0	0
Woodchipper/Spreader	0	0	0	0	0	0	0	0	0	0	0	0	0
Grader/Maintainer	0	0	0	0	0	0	0	0	0	0	0	0	0
Landfill Tipper	0	0	0	0	0	0	0	0	0	0	0	0	0
Catch Basin Cleaner	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydraulic Concrete Breaker	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete Mixer	0	0	0	0	0	0	0	0	0	0	0	0	0
Air Compressor	200	0	0	0	0	0	0	0	0	0	0	0	0
Other 1	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	0	0	0	0	0	0	0	0	0	0	0	0	0
Gasoline Gallon Equivalent Total	200	451	0	0	0	0	0	0	0	0	148	126	0

GREET Fleet Tutorial – Calculating Current Off-Road Fleet's Footprint

- Third step: adjust fuel production assumptions if needed
  - In this demo we will enter a custom electricity mix, which will apply to both the electric and hydrogen (electrolysis) equipment

6. Fuel Production Assumptions

Ethanol Feedstock Source	1	1 - Corn 2 - Switchgrass
CNG Feedstock Source	1	1 - North American NG 2 - Non-North American NG
LNG Feedstock Source	1	1 - North American NG 2 - Non-North American NG
LPG Feedstock Source	NG 60%	Petroleum 40%
Source of Electricity for Off-Road Electric Equipment and H2 Electrolysis	4	1 - Average U.S. Mix 2 - Average Northeast Mix 3 - Average California Mix 4 - User Defined (go to 'Specs' sheet)
G.H2 Production Process	3	1 - Refueling Station SMR (On-site) 2 - Central Plant SMR (Off-site) 3 - Refueling Station Electrolysis (On-site)
L.H2 Production Process	1	1 - Refueling Station SMR (On-site) 2 - Central Plant SMR (Off-site) 3 - Refueling Station Electrolysis (On-site)

GREET Fleet Tutorial – Calculating Current Off-Road Fleet's Footprint

- Third step (continued): go to 'Specs sheet: Table 6' and adjust off-road "User Defined" mix

6. Electric Generation Mix: Data Table for Off-Road Simulation

	U.S. Mix Transportation	NE U.S. Mix Transportation	CA Mix Transportation	User Mix Transportation
Residual oil	1.1%	2.2%	0.0%	0.0%
Natural gas	18.3%	21.7%	36.6%	100.0%
Coal	50.4%	29.9%	13.3%	0.0%
Nuclear power	20.0%	33.9%	20.5%	0.0%
Biomass	0.7%	2.2%	1.3%	0.0%
Others (Wind, Solar, Hydro, etc)	9.5%	10.1%	28.3%	0.0%

  - Return to 'Off-road fleet sheet'

GREET Fleet Tutorial – Calculating Current Off-Road Fleet's Footprint

- Final step: view petroleum results

7. Results of Off-Road Fleet's Petroleum Usage (barrels)

	Gasoline	Diesel	Electricity	G.H2	Vehicle Total
Forklift	0.0	10.3	0.04	0.04	10.4
Skid Loader	0.0	0.0	0.0	0.0	0.0
Front-end Loader	0.0	0.0	0.0	0.0	0.0
Crane	0.0	0.0	0.0	0.0	0.0
Backhoe/Loader	0.0	0.0	0.0	0.0	0.0
Excavator	0.0	0.0	0.0	0.0	0.0
Bulldozer	0.0	0.0	0.0	0.0	0.0
Asphalt Paver	0.0	0.0	0.0	0.0	0.0
Asphalt Roller	0.0	0.0	0.0	0.0	0.0
Compactor	0.0	0.0	0.0	0.0	0.0
Woodchipper/Spreader	0.0	0.0	0.0	0.0	0.0
Grader/Maintainer	0.0	0.0	0.0	0.0	0.0
Landfill Tipper	0.0	0.0	0.0	0.0	0.0
Catch Basin Cleaner	0.0	0.0	0.0	0.0	0.0
Hydraulic Concrete Breaker	0.0	0.0	0.0	0.0	0.0
Concrete Mixer	0.0	0.0	0.0	0.0	0.0
Air Compressor	4.5	0.0	0.0	0.0	4.5
Other 1	0.0	0.0	0.0	0.0	0.0
Other 2	0.0	0.0	0.0	0.0	0.0
Other 3	0.0	0.0	0.0	0.0	0.0
Other 4	0.0	0.0	0.0	0.0	0.0
Other 5	0.0	0.0	0.0	0.0	0.0
Fuel Total	4.5	10.3	0.04	0.04	

Off-Road Fleet Total 14.9 barrels of oil

Note: Several fuels are not shown for clarity in this presentation

GREET Fleet Tutorial – Calculating Current Off-Road Fleet's Footprint

- Final step (continued): view greenhouse gas results

8. Results of Off-Road Fleet's Greenhouse Gas Emissions (short tons CO2-equivalent)

	Gasoline	Diesel	Electricity	G.H2	Vehicle Total
Forklift	0.0	5.6	3.5	4.4	13.5
Skid Loader	0.0	0.0	0.0	0.0	0.0
Front-end Loader	0.0	0.0	0.0	0.0	0.0
Crane	0.0	0.0	0.0	0.0	0.0
Backhoe/Loader	0.0	0.0	0.0	0.0	0.0
Excavator	0.0	0.0	0.0	0.0	0.0
Bulldozer	0.0	0.0	0.0	0.0	0.0
Asphalt Paver	0.0	0.0	0.0	0.0	0.0
Asphalt Roller	0.0	0.0	0.0	0.0	0.0
Compactor	0.0	0.0	0.0	0.0	0.0
Woodchipper/Spreader	0.0	0.0	0.0	0.0	0.0
Grader/Maintainer	0.0	0.0	0.0	0.0	0.0
Landfill Tipper	0.0	0.0	0.0	0.0	0.0
Catch Basin Cleaner	0.0	0.0	0.0	0.0	0.0
Hydraulic Concrete Breaker	0.0	0.0	0.0	0.0	0.0
Concrete Mixer	0.0	0.0	0.0	0.0	0.0
Air Compressor	2.5	0.0	0.0	0.0	2.5
Other 1	0.0	0.0	0.0	0.0	0.0
Other 2	0.0	0.0	0.0	0.0	0.0
Other 3	0.0	0.0	0.0	0.0	0.0
Other 4	0.0	0.0	0.0	0.0	0.0
Other 5	0.0	0.0	0.0	0.0	0.0
Fuel Total	2.5	5.6	3.5	4.4	

Off-Road Fleet Total **16.0 short tons of GHG emissions**

Note: Several fuels are not shown for clarity in this presentation

EPA is Replacing MOBILE and NONROAD Emission Models with MOtor Vehicle Emission Simulator (MOVES)

- DRAFTMOVES2009 was released in April 2009 for review
  - The sooner they receive comments, the more likely they will be addressed in the public version
- Official MOVES2009 planned for release at the end of 2009
- Use will be required for:
  - SIPs
  - Regional conformity analysis
  - Project level conformity for PM and CO
  - NEPA analysis (e.g., air toxics)

Comparing MOBILE and MOVES

- **MOBILE**
  - Uses text input and output files
  - Written in outdated programming language (Fortran) and difficult to update
  - Gram/mile emission factors and fixed output formats
  - Emission rates based on regional-scale trip patterns
  - Based on aggregate driving cycles
- **MOVES**
  - Has a graphical user interface
  - Uses Java/MySQL software and stores info in databases which are easy to update
  - Gram/mile emission factors & for some processes gram/time and easily customizable output
  - Emission inventories from national to county to project level
  - Based on “operating modes” which takes into account second-by-second activity

Estimating AFV Criteria Pollutant Credits

- As the tailpipe emission standards have become more stringent, the criteria pollutant benefits for AFV as compared to conventional fuels have diminished

- EPA is focusing their MOVES effort on gasoline and diesel and to a lesser extent ethanol and biodiesel
  - CNG, LPG, and electricity are in DRAFTMOVES 2009

- Argonne's AirCRED tool was developed using MOBILE
  - Plan to work within MOVES to assist fleets using this software
  - Could potentially add a module and/or develop a user guide specific to fleets

Thank you!!!

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Linda Bluestein: U.S. Department of Energy

Dennis Smith: U.S. Department of Energy

Michael Wang: Argonne National Laboratory

Marcy Rood Werpy: Argonne National Laboratory

Marianne Mintz: Argonne National Laboratory

For additional information contact:

aburnham@anl.gov